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PATENT COOPERATION TREATY

From the INTERNATIONAL BUREAU

PCT

NOTIFICATION OF ELECTION

(PCT Rule 61.2)

To:

Commissioner
US Department of Commerce
United States Patent and Trademark Office, PCT
2011 South Clark Place Room
CP2/5C24
Arlington, VA 22202
ETATS-UNIS D'AMERIQUE

in its capacity as elected Office

Date of mailing (day/month/year) 16 May 2001 (16.05.01)	
International application No. PCT/NL00/00574	**Applicant's or agent's file reference** BO 42676 AS
International filing date (day/month/year) 17 August 2000 (17.08.00)	**Priority date** (day/month/year) 19 August 1999 (19.08.99)
Applicant STOFFERS, Johannes, Andreas et al	

1. The designated Office is hereby notified of its election made:

[X] in the demand filed with the International Preliminary Examining Authority on:

09 March 2001 (09.03.01)

[ ] in a notice effecting later election filed with the International Bureau on:

2. The election [X] was

[ ] was not

made before the expiration of 19 months from the priority date or, where Rule 32 applies, within the time limit under Rule 32.2(b).

The International Bureau of WIPO
34, chemin des Colombettes
1211 Geneva 20, Switzerland

Facsimile No.: (41-22) 740.14.35

Authorized officer

Pascal Piriou

Telephone No.: (41-22) 338.83.38

PATENT COOPERATION TREATY

From the INTERNATIONAL BUREAU

PCT

NOTIFICATION OF THE RECORDING OF A CHANGE

(PCT Rule 92bis.1 and Administrative Instructions, Section 422)

To:

JORRITSMA, Ruurd
Nederlandsch Octrooibureau
Scheveningseweg 82
P.O. Box 29720
NL-2502 LS The Hague
PAYS-BAS

Date of mailing (day/month/year) 08 February 2002 (08.02.02)	
Applicant's or agent's file reference BO 42676 AS	**IMPORTANT NOTIFICATION**
International application No. PCT/NL00/00574	**International filing date** (day/month/year) 17 August 2000 (17.08.00)

1. The following indications appeared on record concerning:

[X] the applicant [X] the inventor [ ] the agent [ ] the common representative

Name and Address	State of Nationality	State of Residence
SONNEVELD, Pieter, Jan Van Schermbeeklaan 8 NL-7603 GJ Wageningen Netherlands	NL	NL
	Telephone No.	
	Facsimile No.	
	Teleprinter No.	

2. The International Bureau hereby notifies the applicant that the following change has been recorded concerning:

[ ] the person [ ] the name [X] the address [ ] the nationality [ ] the residence

Name and Address	State of Nationality	State of Residence
SONNEVELD, Pieter, Jan Van Schermbeeklaan 8 NL-6703 GJ Wageningen Netherlands	NL	NL
	Telephone No.	
	Facsimile No.	
	Teleprinter No.	

3. Further observations, if necessary:

4. A copy of this notification has been sent to:

[X] the receiving Office
[ ] the International Searching Authority
[ ] the International Preliminary Examining Authority
[ ] the designated Offices concerned
[X] the elected Offices concerned
[ ] other:

The International Bureau of WIPO **34, chemin des Colombettes** **1211 Geneva 20, Switzerland**	Authorized officer Ki-Nam HA
Facsimile No.: (41-22) 740.14.35	Telephone No.: (41-22) 338.83.38

PATENT COOPERATION TREATY

From the INTERNATIONAL BUREAU

PCT

NOTIFICATION OF THE RECORDING OF A CHANGE

(PCT Rule 92bis.1 and Administrative Instructions, Section 422)

To:

JORRITSMA, Ruurd
Nederlandsch Octrooibureau
Scheveningseweg 82
P.O. Box 29720
NL-2502 LS The Hague
PAYS-BAS

Date of mailing (day/month/year)
28 June 2001 (28.06.01)

Applicant's or agent's file reference
BO 42676 AS

IMPORTANT NOTIFICATION

International application No.
PCT/NL00/00574

International filing date (day/month/year)
17 August 2000 (17.08.00)

1. The following indications appeared on record concerning:

[X] the applicant [ ] the inventor [ ] the agent [ ] the common representative

Name and Address

INSTITUUT VOOR MILIEU-EN AGRITECHNIEK (IMAG-DLO)
P.O. Box 43
NL-6700 AA Wageningen
Netherland

State of Nationality: NL
State of Residence: NL
Telephone No.:
Facsimile No.:
Teleprinter No.:

2. The International Bureau hereby notifies the applicant that the following change has been recorded concerning:

[ ] the person [X] the name [X] the address [ ] the nationality [ ] the residence

Name and Address

INSTITUUT VOOR MILIEU- EN AGRITECHNIEK (IMAG) B.V.
Mansholtlaan 10-12
NL-6708 PA Wageningen
Netherlands

State of Nationality: NL
State of Residence: NL
Telephone No.:
Facsimile No.:
Teleprinter No.:

3. Further observations, if necessary:

4. A copy of this notification has been sent to:

[X] the receiving Office
[X] the International Searching Authority
[ ] the International Preliminary Examining Authority
[ ] the designated Offices concerned
[X] the elected Offices concerned
[ ] other:

The International Bureau of WIPO
34, chemin des Colombettes
1211 Geneva 20, Switzerland

Facsimile No.: (41-22) 740.14.35

Authorized officer
Ingrid Aulich

Telephone No.: (41-22) 338.83.38

Form PCT/IB/306 (March 1994) 004118547

14

PATENT COOPERATION TREATY

PCT

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(PCT Article 36 and Rule 70)

Applicant's or agent's file reference	FOR FURTHER ACTION	See Notification of Transmittal of International Preliminary Examination Report (Form PCT/IPEA/416)
BO 42676 Bot		
International application No.	International filing date *(day/month/year)*	Priority date *(day/month/year)*
PCT/NL00/00574	17/08/2000	19/08/1999
International Patent Classification (IPC) or national classification and IPC A01G9/14		
Applicant INSTITUUT VOOR MILIEU-EN AGRITECHNIEK... et al.		

1. This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.

2. This REPORT consists of a total of 4 sheets, including this cover sheet.

   ☐ This report is also accompanied by ANNEXES, i.e. sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).

   These annexes consist of a total of sheets.

3. This report contains indications relating to the following items:

   - I ☒ Basis of the report
   - II ☐ Priority
   - III ☐ Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
   - IV ☐ Lack of unity of invention
   - V ☒ Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations suporting such statement
   - VI ☐ Certain documents cited
   - VII ☐ Certain defects in the international application
   - VIII ☐ Certain observations on the international application

Date of submission of the demand	Date of completion of this report
09/03/2001	20.04.2001
Name and mailing address of the international preliminary examining authority: European Patent Office D-80298 Munich Tel. +49 89 2399 - 0 Tx: 523656 epmu d Fax: +49 89 2399 - 4465	Authorized officer Van Woensel, G Telephone No. +49 89 2399 2089

Form PCT/IPEA/409 (cover sheet) (January 1994)

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No. PCT/NL00/00574

I. Basis of th r port

1. With regard to the **elements** of the international application *(Replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report since they do not contain amendments (Rules 70.16 and 70.17))*:
Description, pages:

1-4 as originally filed

Claims, No.:

1-13 as originally filed

Drawings, sheets:

1/3-3/3 as originally filed

2. With regard to the **language**, all the elements marked above were available or furnished to this Authority in the language in which the international application was filed, unless otherwise indicated under this item.

These elements were available or furnished to this Authority in the following language: , which is:

- ☐ the language of a translation furnished for the purposes of the international search (under Rule 23.1(b)).
- ☐ the language of publication of the international application (under Rule 48.3(b)).
- ☐ the language of a translation furnished for the purposes of international preliminary examination (under Rule 55.2 and/or 55.3).

3. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, the international preliminary examination was carried out on the basis of the sequence listing:

- ☐ contained in the international application in written form.
- ☐ filed together with the international application in computer readable form.
- ☐ furnished subsequently to this Authority in written form.
- ☐ furnished subsequently to this Authority in computer readable form.
- ☐ The statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.
- ☐ The statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished.

4. The amendments have resulted in the cancellation of:

- ☐ the description, pages:
- ☐ the claims, Nos.:

☐ the drawings, sheets:

5. ☐ This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed (Rule 70.2(c)):

   (Any replacement sheet containing such amendments must be referred to under item 1 and annexed to this report.)

6. Additional observations, if necessary:

V. Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Yes:	Claims	1-13
	No:	Claims	
Inventive step (IS)	Yes:	Claims	1-13
	No:	Claims	
Industrial applicability (IA)	Yes:	Claims	1-13
	No:	Claims	

2. Citations and explanations
   see separate sheet

Ad V

The present application meets the requirements of Article 33 PCT.
None of the prior art documents discloses a greenhouse wherein first pairs of roof surfaces run at an angle with respect to a horizontal from a base edge oriented in the longitudinal direction of the greenhouse to a common apex and wherein second pairs of successive roof surfaces extend at an angle with respect to the horizontal from a base edge oriented in the transversal direction of the greenhouse to a common apex.
None of the prior art documents teaches or suggests that such a zigzag or ribbed pattern of the roof surfaces extending in two perpendicular directions be used in order to increase the light yield of a greenhouse.
Claims 1-13 therefore meets the requirements of Article 33(2)-(3) PCT.
Claims 1-13 is considered to be industrially applicable (Article 33(4) PCT).

31.08.00

PCT

REQUEST

The undersigned requests that the present international application be processed according to the Patent Cooperation Treaty.

For receiving Office use only

PCT/NL 00/00574
International Application No.

17 AUG. 2000 (17.08.00)
International Filing Date

BUREAU VOOR DE INDUSTRIËLE EIGENDOM
PCT. INTERNATIONAL APPLICATION
Name of receiving Office and "PCT International Application"

Applicant's or agent's file reference (if desired) (12 characters maximum): BO 42676 AS

Box No. I TITLE OF INVENTION Greenhouse as well as roof element for such a greenhouse having increased light transmission

Box No. II APPLICANT

Name and address: *(Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country. The country of the address indicated in this Box is the applicant's State (that is, country) of residence if no State of residence is indicated below.)*

Instituut voor Milieu-en Agritechniek (IMAG-DLO
P.O. box 43
NL-6700 AA WAGENINGEN
The Netherlands

☐ This person is also inventor.

Telephone No.

Facsimile No.

Teleprinter No.

State *(that is, country)* of nationality: The Netherlands (NL)

State *(that is, country)* of residence: The Netherlands (NL)

This person is applicant for the purposes of: ☐ all designated States ■ all designated States except the United States of America ☐ the United States of America only ☐ the States indicated in the Supplemental Box

Box No. III FURTHER APPLICANT(S) AND/OR (FURTHER) INVENTOR(S)

Name and address: *(Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country. The country of the address indicated in this Box is the applicant's State (that is, country) of residence if no State of residence is indicated below.)*

STOFFERS, Johannes Andreas
Nic. Beetsstraat 15
NL-4041 XH KESTEREN
The Netherlands

This person is:
☐ applicant only
☒ applicant and inventor
☐ inventor only *(If this check-box is marked, do not fill in below.)*

State *(that is, country)* of nationality: The Netherlands (NL)

State *(that is, country)* of residence: The Netherlands (NL)

This person is applicant for the purposes of: ☐ all designated States ☐ all designated States except the United States of America ☒ the United States of America only ☐ the States indicated in the Supplemental Box

☒ Further applicants and/or (further) inventors are indicated on a continuation sheet.

Box No. IV AGENT OR COMMON REPRESENTATIVE; OR ADDRESS FOR CORRESPONDENCE

The person identified below is hereby/has been appointed to act on behalf of the applicant(s) before the competent International Authorities as: ■ agent ☐ common representative

Name and address: *(Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country.)*

JORRITSMA, Ruurd et al
Nederlandsch Octrooibureau
Scheveningseweg 82, P.O. Box 29720
NL-2502 LS THE HAGUE
THE NETHERLANDS

Telephone No. 70 3527500

Facsimile No. 70 3527528

Teleprinter No.

☐ **Address for correspondence:** Mark this check-box where no agent or common representative is/has been appointed and the space above is used instead to indicate a special address to which correspondence should be sent.

See Notes to the request for

C ntinuation f Box N . III   FURTHER APPLICANT(S) AND/OR (FURTHER) INVENTOR(S)

If none of the following sub-boxes is used, this sheet should not be included in the request.

Name and address: *(Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country. The country of the address indicated in this Box is the applicant's State (that is, country) of residence if no State of residence is indicated below.)*

SONNEVELD, Pieter Jan
Van Schermbeeklaan 8
NL-7603 GJ WAGENINGEN
The Netherlands

This person is:
- ☐ applicant only
- ☒ applicant and inventor
- ☐ inventor only *(If this check-box is marked, do not fill in below.)*

State *(that is, country)* of nationality: The Netherlands (NL)

State *(that is, country)* of residence: The Netherlands (NL)

This person is applicant for the purposes of: ☐ all designated States ☐ all designated States except the United States of America ☒ the United States of America only ☐ the States indicated in the Supplemental Box

Name and address: *(Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country. The country of the address indicated in this Box is the applicant's State (that is, country) of residence if no State of residence is indicated below.)*

This person is:
- ☐ applicant only
- ☐ applicant and inventor
- ☐ inventor only *(If this check-box is marked, do not fill in below.)*

State *(that is, country)* of nationality:

State *(that is, country)* of residence:

This person is applicant for the purposes of: ☐ all designated States ☐ all designated States except the United States of America ☐ the United States of America only ☐ the States indicated in the Supplemental Box

Name and address: *(Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country. The country of the address indicated in this Box is the applicant's State (that is, country) of residence if no State of residence is indicated below.)*

This person is:
- ☐ applicant only
- ☐ applicant and inventor
- ☐ inventor only *(If this check-box is marked, do not fill in below.)*

State *(that is, country)* of nationality:

State *(that is, country)* of residence:

This person is applicant for the purposes of: ☐ all designated States ☐ all designated States except the United States of America ☐ the United States of America only ☐ the States indicated in the Supplemental Box

Name and address: *(Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country. The country of the address indicated in this Box is the applicant's State (that is, country) of residence if no State of residence is indicated below.)*

This person is:
- ☐ applicant only
- ☐ applicant and inventor
- ☐ inventor only *(If this check-box is marked, do not fill in below.)*

State *(that is, country)* of nationality:

State *(that is, country)* of residence:

This person is applicant for the purposes of: ☐ all designated States ☐ all designated States except the United States of America ☐ the United States of America only ☐ the States indicated in the Supplemental Box

☐ Further applicants and/or (further) inventors are indicated on another continuation sheet.

Box No.V DESIGNATION OF STATES

The following designations are hereby made under Rule 4.9(a) *(mark the applicable check-boxes; at least one must be marked)*:

Regional Patent

- ■ **AP** **ARIPO Patent:** GH Ghana, GM Gambia, KE Kenya, LS Lesotho, MW Malawi, MZ Mozambique, SD Sudan, SL Sierra Leone, SZ Swaziland, TZ United Republic of Tanzania, UG Uganda, ZW Zimbabwe, and any other State which is a Contracting State of the Harare Protocol and of the PCT
- ■ **EA** **Eurasian Patent:** AM Armenia, AZ Azerbaijan, BY Belarus, KG Kyrgyzstan, KZ Kazakhstan, MD Republic of Moldova, RU Russian Federation, TJ Tajikistan, TM Turkmenistan, and any other State which is a Contracting State of the Eurasian Patent Convention and of the PCT
- ■ **EP** **European Patent:** AT Austria, BE Belgium, CH and LI Switzerland and Liechtenstein, CY Cyprus, DE Germany, DK Denmark, ES Spain, FI Finland, FR France, GB United Kingdom, GR Greece, IE Ireland, IT Italy, LU Luxemburg, MC Monaco, NL Netherlands, PT Portugal, SE Sweden, and any other State which is a Contracting State of the European Patent Convention and of the PCT
- ■ **OA** **OAPI Patent:** BF Burkina Faso, BJ Benin, CF Central African Republic, CG Congo, CI Côte d'Ivoire, CM Cameroon, GA Gabon, GN Guinea, GW Guinea-Bissau, ML Mali, MR Mauritania, NE Niger, SN Senegal, TD Chad, TG Togo, and any other State which is a member State of OAPI and a Contracting State of the PCT *(if other kind of protection or treatment desired, specify on dotted line)* .....

National Patent *(if other kind of protection or treatment desired, specify on dotted line)*:

- ■ **AE** United Arab Emirates
- ■ **AG** Antigua and Barbuda
- ■ **AL** Albania .....
- ■ **AM** Armenia .....
- ■ **AT** Austria .....
- ■ **AU** Australia .....
- ■ **AZ** Azerbaijan
- ■ **BA** Bosnia and Herzegovina .....
- ■ **BB** Barbados
- ■ **BG** Bulgaria .....
- ■ **BR** Brazil .....
- ■ **BY** Belarus .....
- ■ **BZ** Belize
- ■ **CA** Canada
- ■ **CH and LI** Switzerland and Liechtenstein
- ■ **CN** China .....
- ■ **CR** Costa Rica .....
- ■ **CU** Cuba .....
- ■ **CZ** Czech Republic .....
- ■ **DE** Germany .....
- ■ **DK** Denmark .....
- ■ **DM** Dominica
- ■ **DZ** Algeria .....
- ■ **EE** Estonia .....
- ■ **ES** Spain .....
- ■ **FI** Finland .....
- ■ **GB** United Kingdom
- ■ **GD** Grenada
- ■ **GE** Georgia .....
- ■ **GH** Ghana .....
- ■ **GM** Gambia
- ■ **HR** Croatia .....
- ■ **HU** Hungary .....
- ■ **ID** Indonesia
- ■ **IL** Israel .....
- ■ **IN** India .....
- ■ **IS** Iceland
- ■ **JP** Japan .....
- ■ **KE** Kenya .....
- ■ **KG** Kyrgyzstan .....
- ■ **KP** Democratic People's Republic of Korea .....
- ■ **KR** Republic of Korea .....
- ■ **KZ** Kazakhstan .....
- ■ **LC** Saint Lucia
- ■ **LK** Sri Lanka
- ■ **LR** Liberia
- ■ **LS** Lesotho .....
- ■ **LT** Lithuania
- ■ **LU** Luxembourg
- ■ **LV** Latvia
- ■ **MA** Morocco .....
- ■ **MD** Republic of Moldova .....
- ■ **MG** Madagascar .....
- ■ **MK** The former Yugoslav Republic of Macedonia .....
- ■ **MN** Mongolia
- ■ **MW** Malawi .....
- ■ **MX** Mexico .....
- ■ **MZ** Mozambique
- ■ **NO** Norway
- ■ **NZ** New Zealand .....
- ■ **PL** Poland .....
- ■ **PT** Portugal .....
- ■ **RO** Romania
- ■ **RU** Russian Federation .....
- ■ **SD** Sudan
- ■ **SE** Sweden
- ■ **SG** Singapore
- ■ **SI** Slovenia .....
- ■ **SK** Slovakia .....
- ■ **SL** Sierra Leone .....
- ■ **TJ** Tajikistan .....
- ■ **TM** Turkmenistan .....
- ■ **TR** Turkey .....
- ■ **TT** Trinidad and Tobago .....
- ■ **TZ** United Republic of Tanzania
- ■ **UA** Ukraine .....
- ■ **UG** Uganda .....
- ■ **US** United States of America .....
- ■ **UZ** Uzbekistan .....
- ■ **VN** Viet Nam .....
- ■ **YU** Yugoslavia .....
- ■ **ZA** South Africa .....
- ■ **ZW** Zimbabwe .....

Check-box reserved for designating States which have become party to the PCT after issuance of this sheet:

☐ .....

Precautionary Designation Statement: In addition to the designations made above, the applicant also makes under Rule 4.9(b) all other designations which would be permitted under the PCT except any designation(s) indicated in the Supplemental Box as being excluded from the scope of this statement. The applicant declares that those additional designations are subject to confirmation and that any designation which is not confirmed before the expiration of 15 months from the priority date is to be regarded as withdrawn by the applicant at the expiration of that time limit. *(Confirmation (including fees) must reach the receiving Office within the 15-month time limit.)*

Box No. VI PRIORITY CLAIM ☐ Further priority claims are indicated in the Supplemental Box.

Filing date of earlier application (day/month/year)	Number of earlier application	The earlier application is: national application: country	regional application:* regional Office	international application: receiving Office
item (1) 19 August 1999 (19.08.99)	1012866	The Netherlands		
item (2)				
item (3)				

☒ The receiving Office is requested to prepare and transmit to the International Bureau a certified copy of the earlier application(s) *(only if the earlier application was filed with the Office which for the purposes of the present international application is the receiving Office)* identified above as item(s): 1

* *Where the earlier application is an ARIPO application, it is mandatory to indicate in the Supplemental Box at least one country party to the Paris Convention for the Protection of Industrial Property for which that earlier application was filed (Rule 4.10(b)(ii)). See Supplemental Box.*

Box No. VII INTERNATIONAL SEARCHING AUTHORITY

Choice of International Searching Authority (ISA) *(if two or more International Searching Authorities are competent to carry out the international search, indicate the Authority chosen; the two-letter code may be used):*
ISA / EPO

Request to use results of earlier search; reference to that search *(if an earlier search has been carried out by or requested from the International Searching Authority):*

Date (day/month/year)	Number	Country (or regional Office)
18 April 2000	SN 33779 NL	The Netherlands

Box No. VIII CHECK LIST; LANGUAGE OF FILING

This international application contains the following **number of sheets:**

request	: 4
description (excluding sequence listing part)	: 4
claims	: 2 3
abstract	: 1
drawings	: 3
sequence listing part of description	:
Total number of sheets	: 15

This international application is **accompanied** by the item(s) marked below:

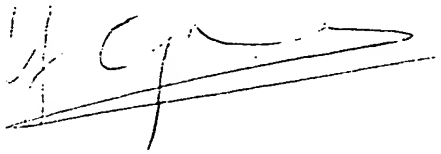
1. ☒ fee calculation sheet
2. ☐ separate signed power of attorney
3. ☐ copy of general power of attorney; reference number, if any:
4. ☐ statement explaining lack of signature
5. ☐ priority document(s) identified in Box No. VI as item(s):
6. ☐ translation of international application into (language):
7. ☐ separate indications concerning deposited microorganism or other biological material
8. ☐ nucleotide and/or amino acid sequence listing in computer readable form
9. ☒ other *(specify)*: Copy search report

Figure of the drawings which should accompany the abstract: Fig. 1

Language of filing of the international application: English

Box No. IX SIGNATURE OF APPLICANT OR AGENT

Next to each signature, indicate the name of the person signing and the capacity in which the person signs (if such capacity is not obvious from reading the request).



GROENEVELD, Yme G.

Nederlandsch Octrooibureau, The Hague, 17 August 2000

For receiving Office use only

1. Date of actual receipt of the purported international application: 17 AUG 2000 (17.08.00)
2. Drawings: ☒ received: ☐ not received:
3. Corrected date of actual receipt due to later but timely received papers or drawings completing the purported international application:
4. Date of timely receipt of the required corrections under PCT Article 11(2):
5. International Searching Authority (if two or more are competent): ISA /
6. ☐ Transmittal of search copy delayed until search fee is paid.

For International Bureau use only

Date of receipt of the record copy by the International Bureau: 08 SEPTEMBER 2000 (08.09.00)

Fig 1

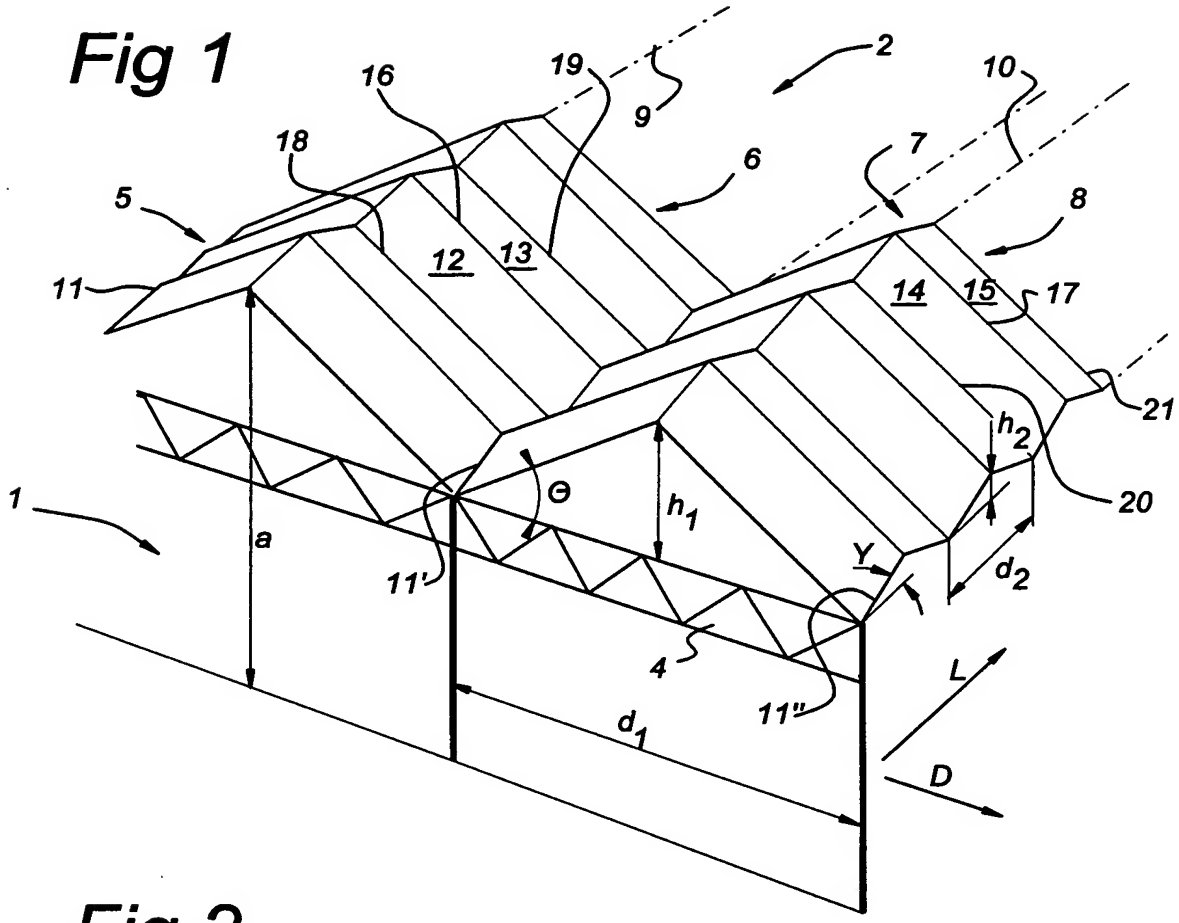

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Fig 2

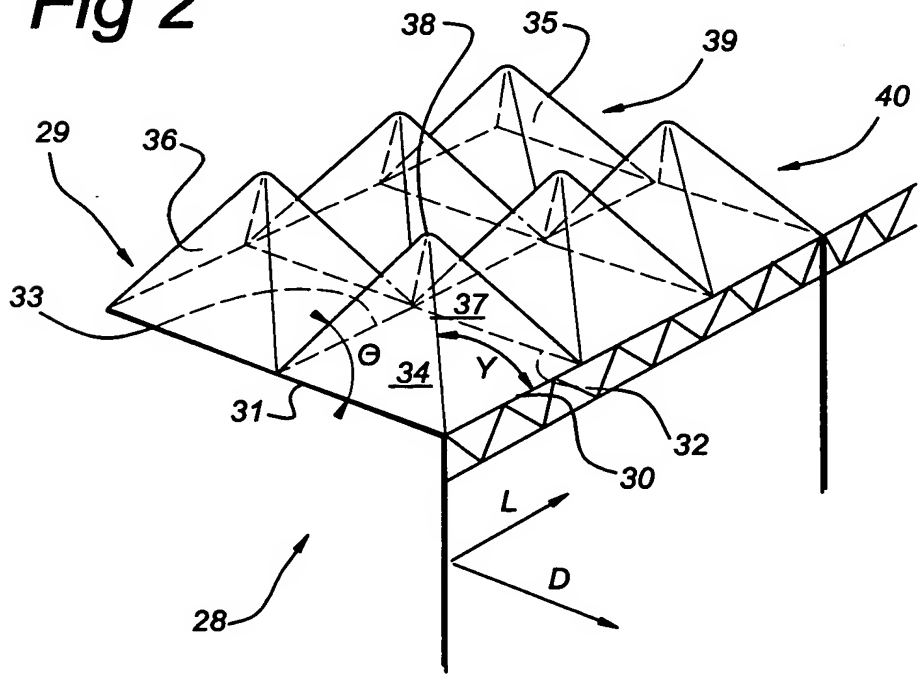
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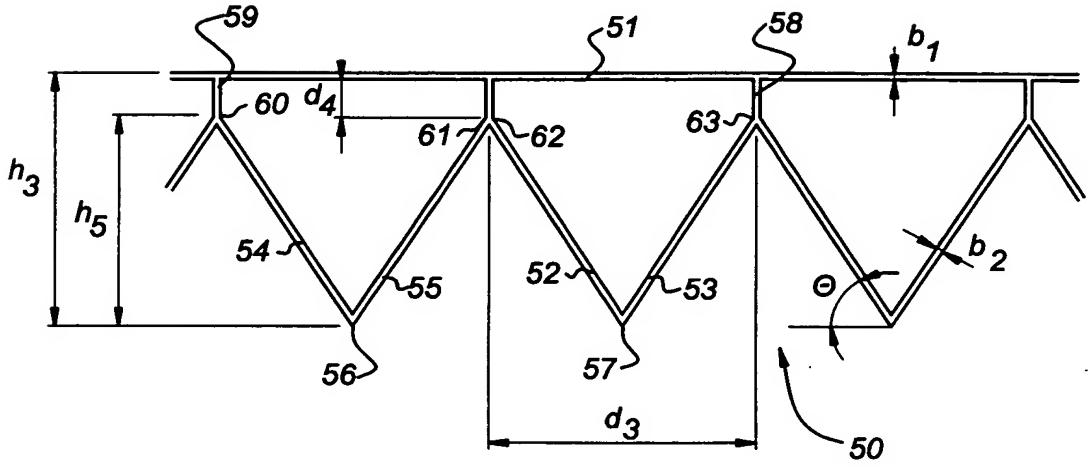
Fig 3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d_3
50

Fig 4

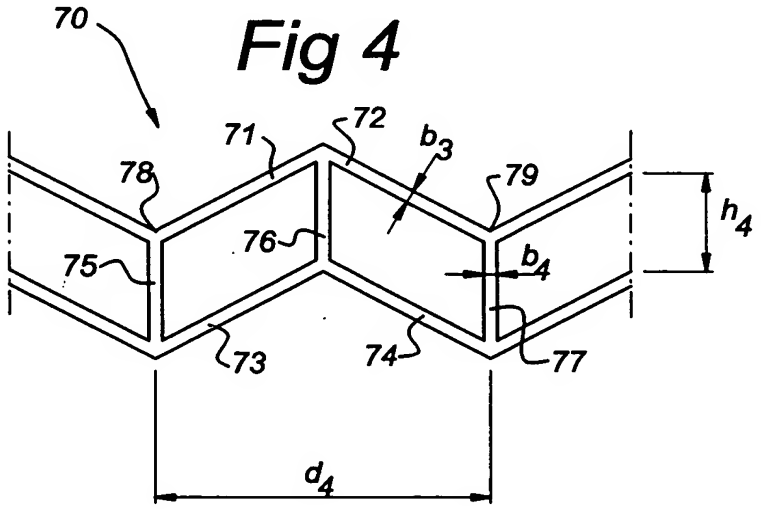

70
71
72
b_3
78
79
h_4
76
75
b_4
73
74
77
d_4

Fig 5

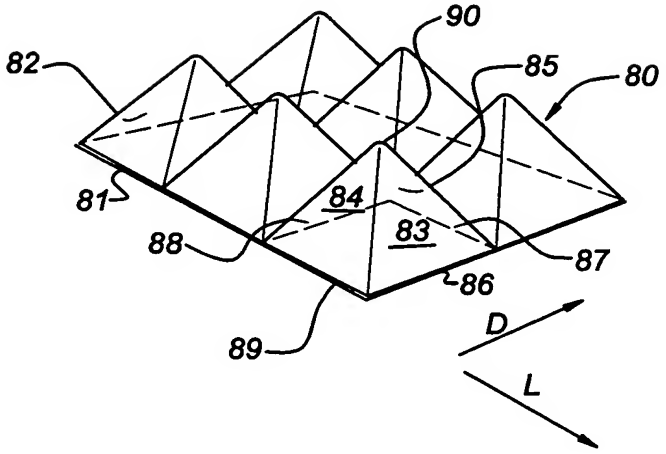
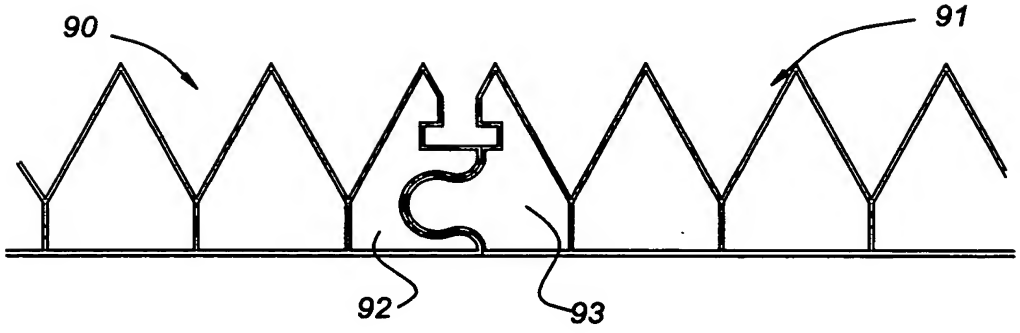


Fig 6



Kas alsmede kapelement voor een dergelijke kas met een verhoogde lichttransmissie.

De uitvinding heeft betrekking op een kas met een lichtdoorlatende kapconstructie met een langsrichting en een loodrecht daarop gelegen dwarsrichting, met verscheidene in de dwarsrichting opeenvolgende paren eerste kapvlakken, waarbij de eerste kapvlakken van een voorafbepaald paar zich ten opzichte van een horizontaal onder een hoek uitstrekken vanaf een, in de langsrichting van de kas georiënteerde basisrand, naar een gemeenschappelijke nok. De uitvinding heeft tevens betrekking op een kapelement voor toepassing in een dergelijke kas.

Uit de publicatie "Second International Symposium on Models for Plantgrowth", environmental control and farm management in protected cultivation, number 456, March 1998 is bekend om tuinbouwkassen te voorzien van in de dwarsrichting opeenvolgende puntvormig naar een nok toe verlopende kapvlakken. Voor hoeken met de horizontaal groter dan 45° blijkt de lichttransmissie voor loodrecht op de kas invallende stralen sterk toe te nemen. Dit is met name in tuinbouwkassen van belang aangezien één procent meer lichtopbrengst resulteert in ca. één procent meer opbrengst aan gewassen.

Het is een doel van de onderhavige uitvinding te voorzien in een kapconstructie van de bovengenoemde soort, voorzien van de hoeveelheid aaneengelegen in een nok samenkomende paren kapvlakken, waarbij de lichtdoorlatendheid wordt verhoogd.

Hiertoe is de kapconstructie volgens de onderhavige uitvinding gekenmerkt doordat de kas tevens in de langsrichting is voorzien van paren opeenvolgende tweede kapvlakken die zich ten opzichte van de horizontaal onder een hoek uitstrekken vanaf een, in de dwarsrichting van kas georiënteerde basisrand naar een gemeenschappelijke nok.

Gebleken is dat een zich in twee loodrechte richtingen uitstrekkend zigzag- of ribbelpatroon van de kapvlakken de lichtopbrengst met 10% - 20% kan verhogen ten opzichte van kapconstructies die uitsluitend in de dwarsrichting zigzagvormig zijn uitgevoerd. In een eerste uitvoeringsvorm vormen de paren kapvlakken piramides die langs hun zijden onderling zijn verbonden tot een aaneengesloten kapconstructie.

In een andere uitvoeringsvorm van een kas volgens de uitvinding raken de paren eerste kapvlakken elkaar langs nokranden, waarbij basisranden en de nokranden van de paren eerste kapvlakken zich onderling parallel in de langsrichting uitstrekken, waarbij

de paren tweede kapvlakken elkaar langs nokranden raken, en waarbij de basisranden en de nokranden van de tweede paren kapvlakken zich onderling parallel uitstrekken vanaf een basisrand van een eerste kapvlak naar de nokrand van het desbetreffende eerste kapvlak. Hierdoor worden in de langsrichting van de kas opeenvolgende dwarsribbels gevormd.

Het verdient de voorkeur om kapelementen met een zigzagpatroon dubbelwandig als kanaalplaat uit te voeren zodat enerzijds een voldoende sterkte en isolerende werking van de kapconstructie wordt verkregen terwijl anderzijds de lichtdoorlatendheid wordt vergroot. De dubbelwandige kapelementen omvatten een basisvlak uit bijvoorbeeld polycarbonaat met een dikte van 0,8 mm waarop een zigzagvormige plaat met ribbels met een hoogte van ca 20 mm is bevestigd. Bij voorkeur wordt het dubbelwandige kapelement uit één stuk gevormd. De kapelementen kunnen modulair zijn uitgevoerd en zijn voorzien van koppelmiddelen voor verbinding met gelijkvormige kapelementen.

Een kas volgens de onderhavige uitvinding alsmede een kapelement zullen nader worden toegelicht aan de hand van de bijgevoegde tekening. In de tekening toont:

figuur 1 een schematisch perspectivisch aanzicht van een kap met een in de dwarsrichting en langsrichting zigzagvormige kapconstructie,

figuur 2 een schematisch perspectivisch aanzicht van een kapconstructie gevormd uit een reeks piramides,

figuur 3 een dwarsdoorsnede van een dubbelwandig kapelement in de vorm van een kanaalplaat volgens de onderhavige uitvinding,

figuur 4 een alternatieve uitvoeringsvorm van een dubbelwandig kapelement in de vorm van een kanaalplaat volgens de uitvinding,

figuur 5 een dubbelwandig kapelement gevormd door een reeks piramides, en

figuur 6 een tweetal kapelementen onderling verbonden door middel van koppelmiddelen.

Figuur 1 toont een kas 1, zoals bijvoorbeeld een kas van het Venlo-type met een lichtdoorlatende kapconstructie 2. De kapconstructie 2 is afgesteund op staanders 3 en horizontale vakwerkliggers 4, die hierin slechts schematisch zijn weergegeven. De hoogte a van een kas zoals getoond in figuur 1 bedraagt bijvoorbeeld 4 m, terwijl de breedte, d_1 in de dwarsrichting D, 8 m bedraagt bij een lengte in langsrichting L van bijvoorbeeld 100 m. De kapconstructie 2 omvat paren eerste kapvlakken 5, 6; 7, 8 die

vanaf een basisrand 11, 11', 11" onder een hoek θ van ca. 20° ten opzichte van de horizontaal verlopen en die onderling zijn bevestigd langs een respectieve nok 9, 10. De hoogte h_1 van de nok 9,10 boven de vakwerkligger 4 bedraagt bijvoorbeeld 1,45 m. In de langsrichting L zijn de paren kapvlakken 5, 6; 7, 8 voorzien van dwarsribbels, gevormd door paren tweede kapvlakken 12,13;14,15. De kapvlakken 12, 13; 14, 15 strekken zich onder een hoek γ uit vanaf basisranden 18, 19; 20, 21 en zijn onderling verbonden langs nokranden 16,17. De afstand d_2 tussen de basisranden 18, 19, 20, 21 van de paren tweede kapvlakken 12, 13; 14, 15 bedraagt bijvoorbeeld 2 cm terwijl de hoogte h_2 van de nokrand 16,17 boven het vlak van de basisranden 18, 19; 20, 21 1,7 cm bedraagt. Door het aanbrengen van de paren zigzagvormige tweede kapvlakken 12, 13; 14, 15 wordt de lichtopbrengst met ca. 10 % verhoogd voor een enkellaags kapconstructie en met ca. 20% voor een dubbellaags kapconstructie zoals wordt getoond in figuur 3 en figuur 4, ten opzichte van bekende kassen waarbij slechts paren eerste kapvlakken 5, 6; 7, 8 aanwezig zijn.

Figuur 2 toont een uitvoeringsvorm van een kas 28 met een kapconstructie 29 waarbij de basisranden 30, 31, 32, 33 van paren eerste kapvlakken 34,35 en paren tweede kapvlakken 36,37 aaneenliggende rechthoeken begrenzen waarboven de kapvlakken 34, 35; 36, 37 in een nok 38 samenkomen zodat een veelheid van piramides 39, 40 wordt gevormd voor vergroting van de lichtopbrengst. Hierbij bedraagt de lengte van de basisranden 31, 32 ca. 1 m, terwijl de hoogte van de piramides 1,7 m bedraagt.

Figuur 3 toont een uitvoeringsvorm van een dubbelwandig kapelement 50 in de vorm van een kanaalplaat met een basisplaat 51 en paren kapvlakken 52, 53, 54, 55 die onderling langs zich loodrecht op het vlak van tekening uitstrekkende nokranden 56, 57 zijn verbonden. Via tussenschotten 58, 59, zijn de basisranden 60, 61, 62, 63 verbonden met de basisplaat 51. De dikte b1 van de basisplaat bedraagt bijvoorbeeld 0,8 mm, de dikte b2 van de vlakken 52, 53, 54, 55 bedraagt bijvoorbeeld 1 mm, de hoogte h3 bedraagt bijvoorbeeld 28 mm terwijl de afstand d3 tussen de basisranden 60, 61, 62, 65 d3, bijvoorbeeld 16 mm bedraagt. De hoogte h5 bedraagt 13,9 mm.

De hoek θ van de kapvlakken 52, 53, 54, 55 met de horizontaal bedraagt 60°. Het materiaal van het dubbelwandige kapelement 50 is bijvoorbeeld polycarbonaat, maar dit element kan eveneens worden gevormd uit iedere andere geschikte transparante kunststof.

Figuur 4 toont een alternatieve uitvoeringsvorm van een dubbelwandig kapelement 70 met een onder een hoek geplaatste kapvlakken 71, 72 en een eveneens onder een hoek geplaatste basisvlakken 73, 74 welke onderling zijn verbonden door tussenschotten 75, 76, 77. De dikte b3 van de kapvlakken 71, 72 bedraagt bijvoorbeeld 1 mm, de afstand h4 tussen de kapvlakken 71, 72 en de basisvlakken 73, 74 bedraagt bijvoorbeeld 20 mm, de dikte b4 van het tussenschot 77 bedraagt bijvoorbeeld 0,8 mm. De afstand d4 tussen de basisranden 78, 79 bedraagt bijvoorbeeld 30 mm.

Figuur 5 toont een uitvoerinsvorm van een uit één deel transparante kunststof gevormd kapelement 80 met een basisplaat 81. Langs vier basisranden 86,87,88,89 van de basisplaat 81 strekken zich vier oppervlakken 82,83,84,85 uit naar een gemeenschappelijk nok 90. Op deze wijze wordt een veelheid van regelmatig over de basisplaat 81 verdeelde piramides gevormd. Hierbij bedraagt de lengte van de basisranden 86,87,88,89 bijvoorbeeld 1,5 m, en is de afstand van de nok 90 tot de basisplaat 81 2,6 m.

Figuur 6 toont tenslotte twee kapelementen 90, 91 die onderling zijn verbonden via complementaire bevestigingsmiddelen 92, 93 die op eenvoudige wijze ineengrijpen en op modulaire wijze een kapconstructie volgens de onderhavige uitvinding vormen.

Conclusies

1. Kas (1,28) omvattende een lichtdoorlatende kapconstructie (2, 29) met een langsrichting (L) en een loodrecht daarop gelegen dwarsrichting (D) met verscheidene in de dwarsrichting (D) opeenvolgende paren eerste kapvlakken (5,6,7,8,36,37), waarbij de eerste kapvlakken van een voorafbepaald paar zich ten opzichte van een horizontaal onder een hoek (θ) uitstrekken vanaf een in de langsrichting (L) van de kas georiënteerde basisrand (11,11',11",30,33), naar een gemeenschappelijke nok (9,10,38), met het kenmerk, dat de kas in de langsrichting (L) is voorzien van paren opeenvolgende tweede kapvlakken (12,13,14,15;34,35) die zich ten opzichte van de horizontaal onder een hoek (γ) uitstrekken vanaf een, in de dwarsrichting D van kas georiënteerde basisrand (18,19,20,21;,31,32) naar een gemeenschappelijke nok (16,17,38).

2. Kas (28) volgens conclusie 1, met het kenmerk, dat vier onderling aangrenzende, loodrechte basisranden (30,31,32,33) telkens een vierhoek begrenzen, waarbij de vierhoeken zich opeenvolgend in de langsrichting (L) en de dwarsrichting (D) van de kapconstructie uitstrekken, en waarbij voor iedere vierhoek eerste en tweede paren kapvlakken (34,35,36,37) zich vanaf de basisranden (30,31,32,33) naar een gemeenschappelijke, boven de respectieve vierhoek gelegen nok (38), uitstrekken.

3. Kas (1) volgens conclusie 1 met het kenmerk, dat de paren eerste kapvlakken (5,6,7,8) elkaar langs nokranden (9,10) raken, waarbij de basisranden (11,11',11") en de nokranden (9,10) van de paren eerste kapvlakken (5,6,7,8) zich onderling parallel in de langsrichting (L) uitstrekken, waarbij de paren tweede kapvlakken (12,13,14,15) elkaar langs nokranden (16,17) raken, en waarbij de basisranden (18,19,20,21) en de nokranden (16,17) van de tweede paren kapvlakken (12,13,14,15) zich onderling parallel uitstrekken vanaf een basisrand (11,11',11") van een eerste kapvlak (5,6,7,8) naar de nokrand (9,10) van het desbetreffende eerste kapvlak.

4. Kas (1,28) volgens een der voorgaande conclusies, met het kenmerk, dat de kapvlakken (52, 53, 54, 55) dubbelwandig zijn uitgevoerd met een basisplaat (51, 73,

74) en dwarsverbindingen (58, 59, 75, 76, 77), tussen de nokpunten en/of de basisranden (60, 61, 62, 63, 78, 79) van de kapvlakken en de basisplaat.

5. Kas (1,28) volgens conclusie 3 of 4, met het kenmerk, dat een afstand (d2,d3,d4) tussen de basisranden (18,19,20,21,78, 79) van de paren tweede kapvlakken (12,13,14,15,71, 72) tussen 0,5 en 0,001 maal de afstand (d1) tussen de basisranden (11,11',11") van de paren eerste kapvlakken (5,6,7,8) bedraagt.

6. Kas (1,28) volgens conclusie 3, 4 of 5, met het kenmerk, dat een loodrechte afstand (h2,h5) tussen de nokrand (16,17,27,28) en de basisranden (18,19,20,21,60, 61, 62, 63) van de paren tweede kapvlakken tussen 0,5 en 0,001 maal de loodrechte afstand tussen de nokrand (9,10) en de basisranden (11,11',11") van de paren eerste kapvlakken (5,6,7,8) bedraagt.

7. Kapelement (50, 80) voor toepassing in een kas, voorzien van verscheidene in een dwarsrichting (D) opeenvolgende paren kapvlakken (52, 53, 54, 55,82,83) en een basisplaat (51,81), waarbij de kapvlakken van een voorafbepaald paar zich ten opzichte van de basisplaats onder een hoek (θ) uitstrekken vanaf een, in een langsrichting (L) georiënteerde basisrand (60, 61, 62, 63,86,88) naar een gemeenschappelijke nok (56, 57,90), welke kapvlakken (52, 53, 54, 55,82,83) langs de basisranden en/of ter plaatse van de nok zijn verbonden met de basisplaat.

8. Kapelement (80) volgens conclusie 7, met het kenmerk, dat het kapelement verder is voorzien van in een langsrichting (L) opeenvolgende paren tweede kapvlakken (84,85) die zich ten opzichte van de basisplaat (81) onder een hoek uitstrekken vanaf een, in een dwarsrichting (D) georiënteerde basisrand (87,89) naar een gemeenschappelijke nok (90), waarbij vier onderling loodrechte basisranden (86,87,88,89) telkens een vierhoek begrenzen, waarbij de vierhoeken zich opeenvolgend in de langsrichting (L) en de dwarsrichting (D) van de basisplaat (81) uitstrekken, en waarbij voor iedere vierhoek eerste en tweede paren kapvlakken (82,83,84,85) zich vanaf de basisranden (86,87,88,89) naar een gemeenschappelijke, boven de respectieve vierhoek gelegen nok (90), uitstrekken.

9. Kapelement (50 ,80) volgens conclusie 7 of 8, met het kenmerk, dat een afstand tussen de basisplaat (51,81) en de nok (56, 57,90) tussen 1 cm en 10 cm bedraagt, bij voorkeur tussen 1,5 cm en 3 cm.

10 Kapelement (50,80) volgens conclusie 7,8 of 9, met het kenmerk, dat de afstand (d3,d4) tussen de basisranden tussen 1 cm en 10 cm bedraagt, bij voorkeur tussen 1,5 cm en 3 cm.

11. Kapelement (50,80) volgens conclusie 7,8,9 of 10, met het kenmerk, dat de hoek (θ) van de kapvlakken tussen 30° en 75° bedraagt, bij voorkeur tussen 45° en 75° .

12. Kapelement (50,80) volgens een der conclusies 7 tot 11, met het kenmerk, dat het kapelement uit één deel bestaat en is gevormd uit transparante kunststof met een wanddikte tussen 0,5 mm en 5 mm, bij voorkeur tussen 0,5 mm en 2 mm.

14. Kapelement (76,77) volgens een der conclusies 7 tot 13, met het kenmerk dat het kapelement is voorzien van koppelmiddelen (78,79) voor verbinding met een gelijkvormig kapelement.

Uittreksel

De uitvinding heeft betrekking op een kas (1) voorzien van een kapelement (2) met een veelheid van dwarsribbels (12,13,14,15) of gelijkmatig over het kapelement verdeelde piramides. Het kapelement kan dubbelwandig als kanaalplaat zijn uitgevoerd uit transparante kunststof en kan een basisplaat omvatten met daarop bevestigd de ribbelvormige of piramidevormige kapvlakken. Met de kapelementen volgens onderhavige uitvinding kan de lichtopbrengst in een tuinbouwkas worden verhoogd.

figuur 1

PATENT COOPERATION TREA

PCT

INTERNATIONAL SEARCH REPORT

(PCT Article 18 and Rules 43 and 44)

Applicant's or agent's file reference	**FOR FURTHER ACTION** see Notification of Transmittal of International Search Report (Form PCT/ISA/220) as well as, where applicable, item 5 below.	
BO 42676 AS		
International application No.	International filing date *(day/month/year)*	(Earliest) Priority Date *(day/month/year)*
PCT/NL 00/ 00574	17/08/2000	19/08/1999
Applicant		
INSTITUUT VOOR MILIEU-EN AGRITECHNIEK (IMAG-DLO)		

This International Search Report has been prepared by this International Searching Authority and is transmitted to the applicant according to Article 18. A copy is being transmitted to the International Bureau.

This International Search Report consists of a total of 2 sheets.

[X] It is also accompanied by a copy of each prior art document cited in this report.

1. **Basis of the report**

   a. With regard to the **language**, the international search was carried out on the basis of the international application in the language in which it was filed, unless otherwise indicated under this item.

   [ ] the international search was carried out on the basis of a translation of the international application furnished to this Authority (Rule 23.1(b)).

   b. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, the international search was carried out on the basis of the sequence listing :

   [ ] contained in the international application in written form.

   [ ] filed together with the international application in computer readable form.

   [ ] furnished subsequently to this Authority in written form.

   [ ] furnished subsequently to this Authority in computer readble form.

   [ ] the statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.

   [ ] the statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished

2. [ ] **Certain claims were found unsearchable** (See Box I).

3. [ ] **Unity of invention is lacking** (see Box II).

4. With regard to the **title**,

   [X] the text is approved as submitted by the applicant.

   [ ] the text has been established by this Authority to read as follows:

5. With regard to the **abstract**,

   [X] the text is approved as submitted by the applicant.

   [ ] the text has been established, according to Rule 38.2(b), by this Authority as it appears in Box III. The applicant may, within one month from the date of mailing of this international search report, submit comments to this Authority.

6. The figure of the **drawings** to be published with the abstract is Figure No. 1

   [X] as suggested by the applicant.

   [ ] because the applicant failed to suggest a figure.

   [ ] because this figure better characterizes the invention.

   [ ] None of the figures.

INTERNATIONAL SEARCH REPORT

International Application No
PCT/NL 00/00574

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 A01G9/14

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 A01G

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)
EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 4 671 025 A (BUTLER ROBERT) 9 June 1987 (1987-06-09) the whole document	1,7
A	DE 34 04 935 A (SPETHMANN HANS DIPL ING) 14 August 1985 (1985-08-14) figures 1,2	1
A	NL 7 809 424 A (PRIVA HANDEL BV) 18 March 1980 (1980-03-18)	
A	GB 2 256 209 A (WALLIS GERALD NORMAN) 2 December 1992 (1992-12-02)	

☐ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

° Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
13 November 2000	17/11/2000

Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL – 2280 HV Rijswijk Tel. (+31–70) 340–2040, Tx. 31 651 epo nl, Fax: (+31–70) 340–3016	Merckx, A

1

Form PCT/ISA/210 (second sheet) (July 1992)

INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No
PCT/NL 00/00574

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GB 2256209 A	02-12-1992	NONE	

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International Bureau

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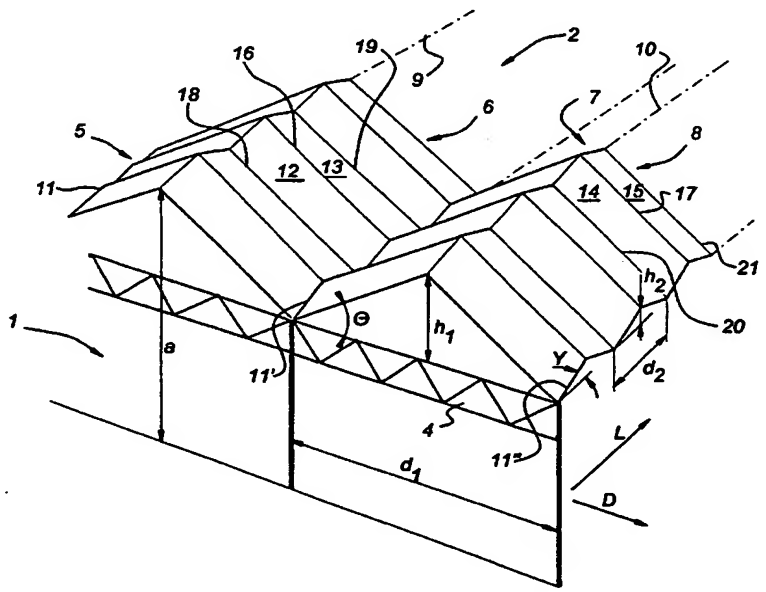
(81) Designated States *(national)*: AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, BZ, CA, CH, CN, CR, CU, CZ, DE, DK, DM, DZ, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, TZ, UA, UG, US, UZ, VN, YU, ZA, ZW.

(84) Designated States *(regional)*: ARIPO patent (GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG).

Published:
— *With international search report.*

[Continued on next page]

(54) Title: GREENHOUSE AS WELL AS ROOF ELEMENT FOR SUCH A GREENHOUSE HAVING INCREASED LIGHT TRANSMISSION



(57) Abstract: The invention relates to a greenhouse (1) provided with a roof element (2) having a multiplicity of transverse ribs (12, 13, 14, 15) or pyramids uniformly distributed over the roof element. The roof element can be constructed double-walled as a hollow-core sheet from transparent plastic and can comprise a base sheet with the rib-shaped or pyramid-shaped roof surfaces fixed thereon. The light yield in a horticultural greenhouse can be increased by means of the roof elements according to the present invention.

WO 01/13704 A1

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INTERNATIONAL SEARCH REPORT

Internal Application No
PCT/NL 00/00574

A. CLASSIFICATION OF SUBJECT MAT
IPC 7 A01G9/14

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 A01G

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)
EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 4 671 025 A (BUTLER ROBERT) 9 June 1987 (1987-06-09) the whole document	1,7
A	DE 34 04 935 A (SPETHMANN HANS DIPL ING) 14 August 1985 (1985-08-14) figures 1,2	1
A	NL 7 809 424 A (PRIVA HANDEL BV) 18 March 1980 (1980-03-18)	
A	GB 2 256 209 A (WALLIS GERALD NORMAN) 2 December 1992 (1992-12-02)	

☐ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

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"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

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Date of the actual completion of the international search	Date of mailing of the international search report
13 November 2000	17/11/2000

Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL – 2280 HV Rijswijk Tel. (+31–70) 340–2040, Tx. 31 651 epo nl, Fax: (+31–70) 340–3016	Merckx, A

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INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No
PCT/NL 00/00574

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 4671025 A	09-06-1987	US 4753054 A	28-06-1988
DE 3404935 A	14-08-1985	NONE	
NL 7809424 A	18-03-1980	BE 878766 A	13-03-1980
		CA 1108371 A	08-09-1981
		FR 2435898 A	11-04-1980
		US 4246730 A	27-01-1981
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Greenhouse as well as roof element for such a greenhouse having increased light transmission

The invention relates to a greenhouse having a transparent roof construction with a longitudinal direction and a transverse direction located perpendicularly thereto, having various pairs of first roof surfaces in succession in the transverse direction, the first roof surfaces of a predetermined pair running at an angle with respect to a horizontal from a base edge oriented in the longitudinal direction of the greenhouse to a common apex. The invention also relates to a roof element for use in such a greenhouse.

It is known from the publication entitled "Second International Symposium on Models for Plant Growth", Environmental Control and Farm Management in Protected Cultivation, number 456, March 1998, to provide horticultural greenhouses with roof surfaces in succession in the transverse direction which run in the shape of a point towards an apex. For angles to the horizontal of greater than 45° the light transmission for radiation which is incident perpendicularly on the greenhouse is found to increase substantially. This is particularly important in horticultural greenhouses since one per cent more light yield results in approximately one per cent more yield of crops.

An aim of the present invention is to provide a roof construction of the above-mentioned type, provided with a quantity of pairs of roof surfaces which are laid in contact with one another and come together in an apex, the light transmission being increased.

To this end the roof construction according to the present invention is characterised in that the greenhouse is also provided with pairs of successive second roof surfaces in the longitudinal direction, which second roof surfaces run at an angle with respect to the horizontal from a base edge oriented in the transverse direction of the greenhouse to a common apex.

It has been found that a zigzag or ribbed pattern of the roof surfaces extending in two perpendicular directions is able to increase the light yield by 10%-20% compared with roof constructions which are of zigzag construction only in the transverse direction. In a first embodiment the pairs of roof surfaces form pyramids which are joined to one another along their sides to give a continuous roof construction.

In another embodiment of a greenhouse according to the invention the pairs of first roof surfaces are in contact with one another along edges at the apex, wherein base edges and the edges at the apex of the pairs of first roof surfaces extend parallel to one another in

the longitudinal direction, wherein the pairs of second roof surfaces are in contact with one another along edges at the apex and wherein the base edges and the edges at the apex of the second pairs of roof surfaces extend parallel to one another from a base edge of a first roof surface to the edge at the apex of the first roof surface concerned. By this means successive transverse ribs are formed in the longitudinal direction of the greenhouse.

It is preferable to construct roof elements with a zigzag pattern double-walled as a hollow-core sheet so that, on the one hand, adequate strength and insulating effect of the roof construction is obtained whilst, on the other hand, the light transmission is increased. The double-walled roof elements comprise a base surface made of, for example, polycarbonate with a thickness of 0.8 mm on which a zigzag-shaped sheet with ribs approximately 20 mm high is fixed. Preferably, the double-walled roof element is made in one piece. The roof elements can be of modular construction and are provided with coupling means for joining to similar roof elements.

A greenhouse according to the present invention and a roof element will be explained in more detail below with reference to the appended drawing. In the drawing:

Figure 1 shows a diagrammatic, perspective view of a roof with a roof construction that is in zigzag form in the transverse direction and the longitudinal direction,

Figure 2 shows a diagrammatic, perspective view of a roof construction formed from a series of pyramids,

Figure 3 shows a cross-section of a double-walled roof element in the form of a hollow-core sheet according to the present invention,

Figure 4 shows an alternative embodiment of a double-walled roof element in the form of a hollow-core sheet according to the invention,

Figure 5 shows a double-walled roof element formed by a series of pyramids, and

Figure 6 shows two roof elements joined to one another by means of coupling means.

Figure 1 shows a greenhouse 1, such as, for example, a greenhouse of the Venlo type having a transparent roof construction 2. The roof construction 2 is supported on uprights 3 and horizontal lattice girders 4, which are shown here diagrammatically only. The height a of a greenhouse as shown in Figure 1 is, for example, 4 m, whilst the width, d_1 in the transverse direction D, is 8 m for a length in the longitudinal direction L of, for example, 100 m. The roof construction 2 comprises pairs of first roof surfaces 5, 6; 7, 8, which run from a base edge 11, 11', 11" at an angle θ of approximately 20° with respect to the horizontal and which are fixed to one another along a respective apex 9, 10. The height h_1

of the apex 9, 10 above the lattice girder 4 is, for example, 1.45 m. In the longitudinal direction L the pairs of roof surfaces 5, 6; 7, 8 are provided with transverse ribs, formed by pairs of second roof surfaces 12, 13; 14, 15. The roof surfaces 12, 13; 14, 15 run at an angle γ from base edges 18, 19; 20, 21 and are joined to one another along edges at the apex 16, 17. The distance d_2 between the base edges 18, 19; 20, 21 of the pairs of second roof surfaces 12, 13; 14, 15 is, for example, 2 cm, whilst the height h_2 of the edge at the apex 16, 17 above the plane of the base edges 18, 19; 20, 21 is 1.7 cm. As a result of fitting the pairs of zigzag-shaped second roof surfaces 12, 13; 14, 15 the light yield is increased by approximately 10% for a single layer roof construction and by approximately 20% for a double layer roof construction as is shown in Figure 3 and Figure 4, compared with known greenhouses where only pairs of first roof surfaces 5, 6; 7, 8 are present.

Figure 2 shows an embodiment of a greenhouse 28 having a roof construction 29 in which the base edges 30, 31, 32, 33 of pairs of first roof surfaces 34, 35 and pairs of second roof surfaces 36, 37 delimit rectangles in contact with one another, above which the roof surfaces 34, 35; 36, 37 come together in an apex 38, so that a multiplicity of pyramids 39, 40 is formed to increase the light yield. Here the length of the base edges 31, 32 is approximately 1 m, whilst the height of the pyramids is 1.7 m.

Figure 3 shows an embodiment of a double-walled roof element 50 in the form of a hollow-core sheet having a base sheet 51 and pairs of roof surfaces 52, 53, 54, 55 which are joined to one another along edges at the apex 56, 57 extending perpendicularly to the plane of the drawing. The base edges 60, 61, 62, 63 are joined via partitions 58, 59 to the base sheet 1. The thickness b_1 of the base sheet is, for example, 0.8 mm, the thickness b_2 of the surfaces 52, 53, 54, 55 is, for example, 1 mm, the height h_3 is, for example, 28 mm, whilst the distance d_3 between the base edges 60, 61, 62, 65 is, for example, 16 mm. The height h_5 is 13.9 mm.

The angle θ of the roof surfaces 52, 53, 54, 55 to the horizontal is 60°. The material of the double-walled roof element 50 is, for example, polycarbonate, but this element can also be made from any other suitable transparent plastic.

Figure 4 shows an alternative embodiment of a double-walled roof element 70 having roof surfaces 71, 72, which are positioned at an angle, and base surfaces 73, 74, which are likewise positioned at an angle and which are joined to one another by partitions 75, 76, 77. The thickness b_3 of the roof surfaces 71, 72 is, for example, 1 mm, the distance h_4 between the roof surfaces 71, 72 and the base surfaces 73, 74 is, for example, 20 mm and

the thickness b_4 of the partition 77 is, for example, 0.8 mm. The distance d_4 between the base edges 78, 79 is, for example, 30 mm.

Figure 5 shows an embodiment of a roof element 80 made from one piece of transparent plastic and having a base sheet 81. Four surfaces 82, 83, 84, 85 extend along four base edges 86, 87, 88, 89 of the base sheet 81 to a common apex 90. In this way a multiplicity of pyramids uniformly distributed over the base sheet 81 are formed. Here the length of the base edges 86, 87, 88, 89 is, for example, 1.5 m and the distance from the apex 90 to the base sheet 81 is 2.6 m.

Finally, Figure 6 shows two roof elements 90, 91 which are joined to one another via complementary fixing means 92, 93 which engage in a simple manner and in modular fashion form a roof construction according to the present invention.

Claims

1. Greenhouse (1,28) comprising a transparent roof construction (2,29) with a longitudinal direction (L) and a transverse direction (D) located perpendicularly thereto, having various pairs of first roof surfaces (5,6,7,8,36,37) in succession in the transverse direction (D), the first roof surfaces of a predetermined pair running at an angle (θ) with respect to a horizontal from a base edge (11,11',11",30,33) oriented in the longitudinal direction (L) of the greenhouse to a common apex (9,10,38), characterised in that the greenhouse is provided with pairs of successive second roof surfaces (12,13,14,15;34,35) in the longitudinal direction (L) , which second roof surfaces extend at an angle (γ) with respect to the horizontal from a base edge (18,19,20,21;31,32) oriented in the transverse direction (D) of the greenhouse to a common apex (16,17,38).

2. Greenhouse (28) according to Claim 1, characterised in that four mutually adjoining perpendicular base edges (30,31,32,33) each time delimit a rectangle, wherein the rectangles extend successively in the longitudinal direction (L) and the transverse direction (D) of the roof construction and wherein, for each rectangle, first and second pairs of roof surfaces (34,35,36,37) extend from the base edges (30,31,32,33) to a common apex (38) located above the rectangle concerned.

3. Greenhouse (1) according to Claim 1, characterised in that the pairs of first roof surfaces (5,6,7,8) are in contact with one another along edges at the apex (9,10), wherein the base edges (11,11',11") and the edges at the apex (9,10) of the pairs of first roof surfaces (5,6,7,8) extend parallel to one another in the longitudinal direction (L), wherein the pairs of second roof surfaces (12,13,14,15) are in contact with one another along edges at the apex (16,17) and wherein the base edges (18,19,20,21) and the edges at the apex (16,17) of the second pairs of roof surfaces (12,13,14,15) extend parallel to one another from a base edge (11,11',11") of a first roof surface (5,6,7,8) to the edge at the apex (9,10) of the first roof surface concerned.

4. Greenhouse (1,28) according to one of the preceding claims, characterised in that the roof surfaces (52,53,54,55) are of double-walled construction, having a base sheet (51,73,74) and transverse links (58,59,75,76,77) between the points of the apexes and/or

the base edges (60,61,62,63,78,79) of the roof surfaces and the base sheet.

5. Greenhouse (1,28) according to Claim 3 or 4, characterised in that a distance (d_2,d_3,d_4) between the base edges (18,19,20,21,78,79) of the pairs of second roof surfaces (12,13,14,15,71,72) is between 0.5 and 0.001 times the distance (d_1) between the base edges (11,11',11") of the pairs of first roof surfaces (5,6,7,8).

6. Greenhouse (1,28) according to Claim 3, 4 or 5, characterised in that a perpendicular distance (h_2,h_5) between the edge at the apex (16,17,27,28) and the base edges (18,19,20,21,60,61,62,63) of the pairs of second roof surfaces is between 0.5 and 0.001 times the perpendicular distance between the edge at the apex (9,10) and the base edges (11,11',11") of the pairs of first roof surfaces (5,6,7,8).

7. Roof element (50,80) for use in a greenhouse, provided with various pairs of roof surfaces (52,53,54,55,82,83) in succession in a transverse direction (D) and a base sheet (51,81), wherein the roof surfaces of a predetermined pair run at an angle (θ) with respect to the base sheet from a base edge (60,61,62,63,86,88) oriented in a longitudinal direction (L) to a common apex (56,57,90), which roof surfaces (52,53,54, 55,82,83) are joined to the base sheet along the base edges and/or at the location of the apex.

8. Roof element (80) according to Claim 7, characterised in that the roof element is furthermore provided with pairs of second roof surfaces (84,85) in succession in a longitudinal direction (L) which run at an angle with respect to the base sheet (81) from a base edge (87,89) oriented in a transverse direction (D) to a common apex (90), wherein four base edges (86,87,88,89) perpendicular to one another always delimit a rectangle, wherein the rectangles extend successively in the longitudinal direction (L) and the transverse direction (D) of the base sheet (81) and wherein, for each rectangle, first and second pairs of roof surfaces (82,83,84,85) extend from the base edges (86,87,88,89) to a common apex (90) located above the rectangle concerned.

9. Roof element (50,80) according to Claim 7 or 8, characterised in that a distance between the base sheet (51,81) and the apex (56,57,90) is between 1 cm and 10 cm, preferably between 1.5 cm and 3 cm.

10. Roof element (50,80) according to Claim 7, 8 or 9, characterised in that the distance (d_3,d_4) between the base edges is between 1 cm and 10 cm, preferably between 1.5 cm and 3 cm.

11. Roof element (50,80) according to Claim 7, 8 or 9, characterised in that the angle (θ) of the roof surfaces is between 30° and 75°, preferably between 45° and 75°.

12. Roof element (50,80) according to one of Claims 7 to 11, characterised in that the roof element consists of one piece and is made from transparent plastic having a wall thickness of between 0.5 mm and 5 mm, preferably between 0.5 mm and 2 mm.

13. Roof element (76,77) according to one of Claims 7 to 12, characterised in that the roof element is provided with coupling means (78,79) for joining to a similar roof element.

Fig 1

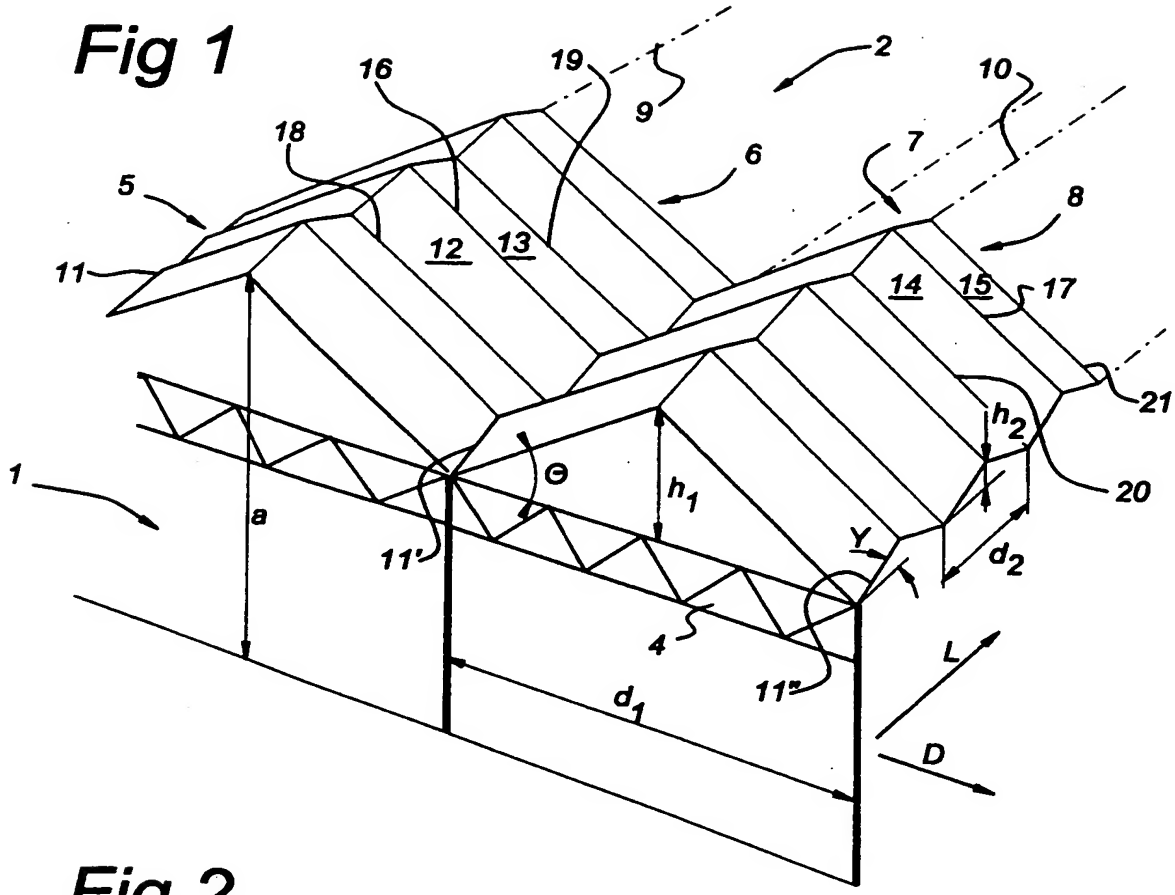
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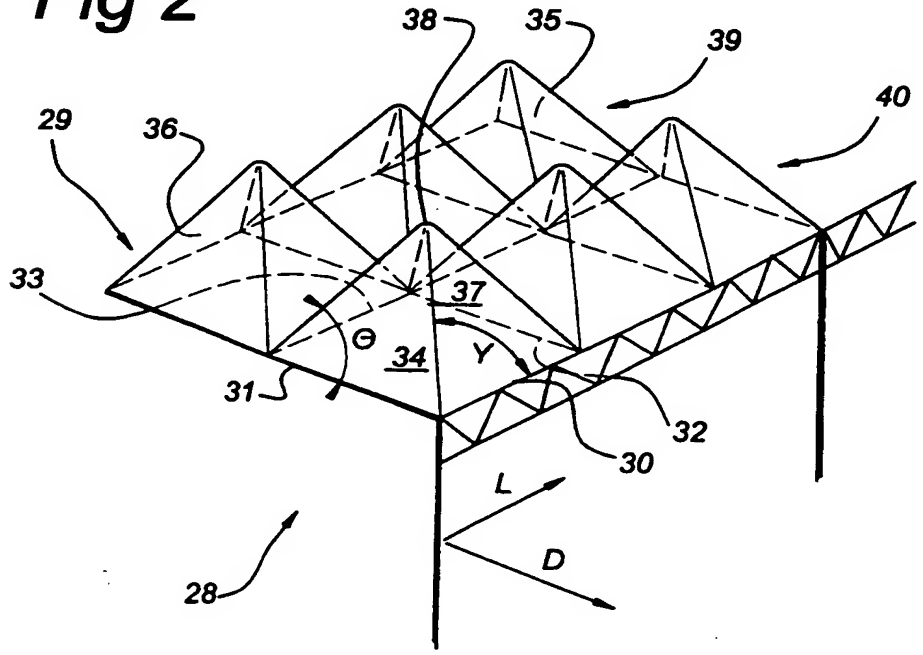
Fig 2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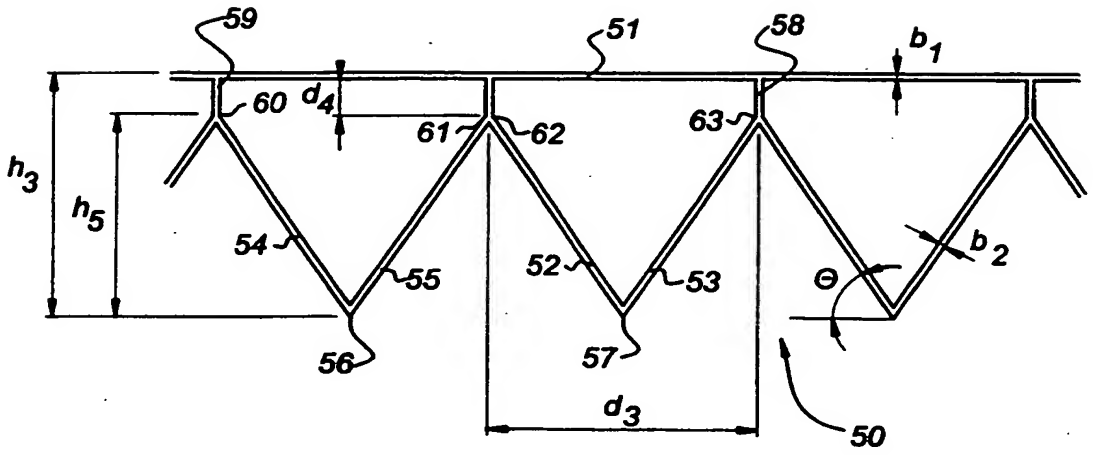
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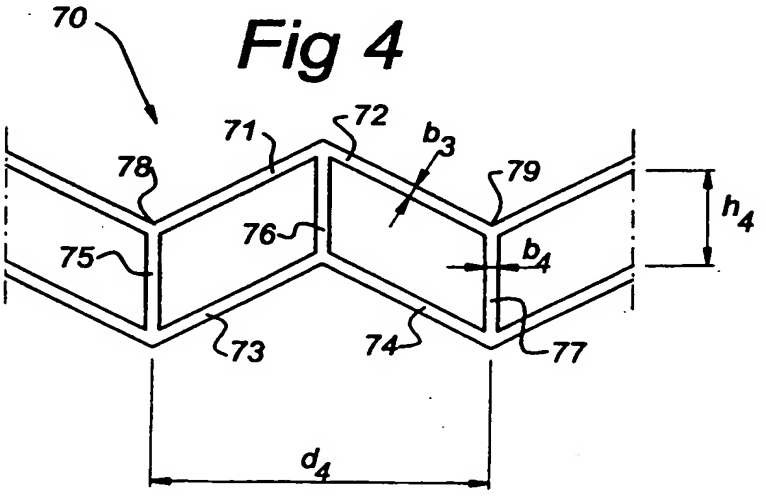
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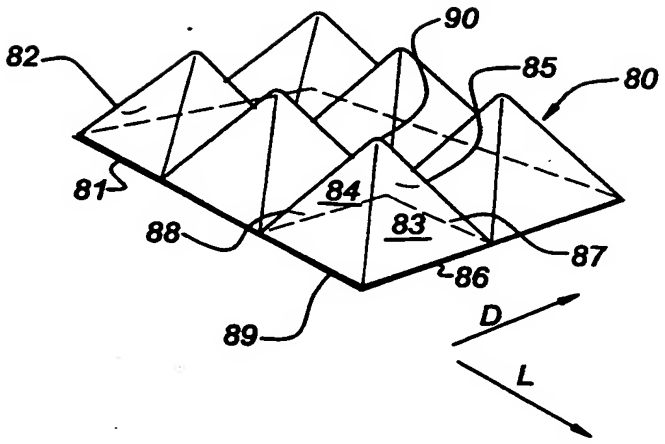

Fig 6

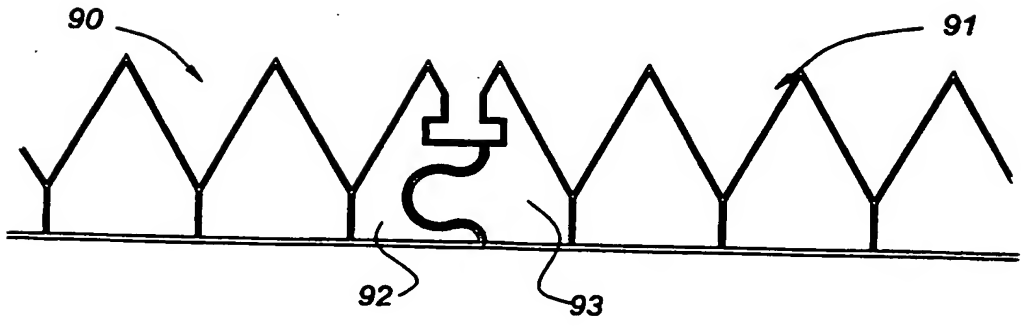

Fig 1

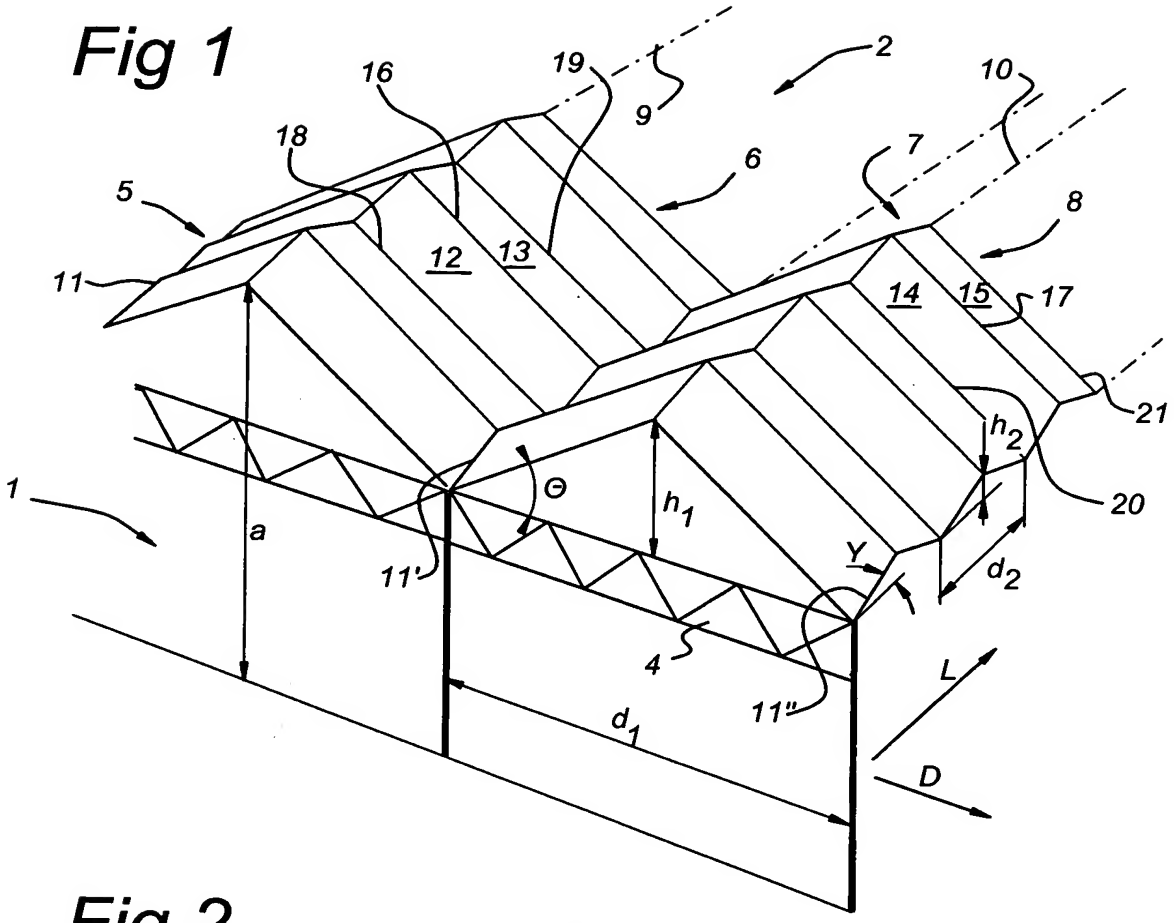
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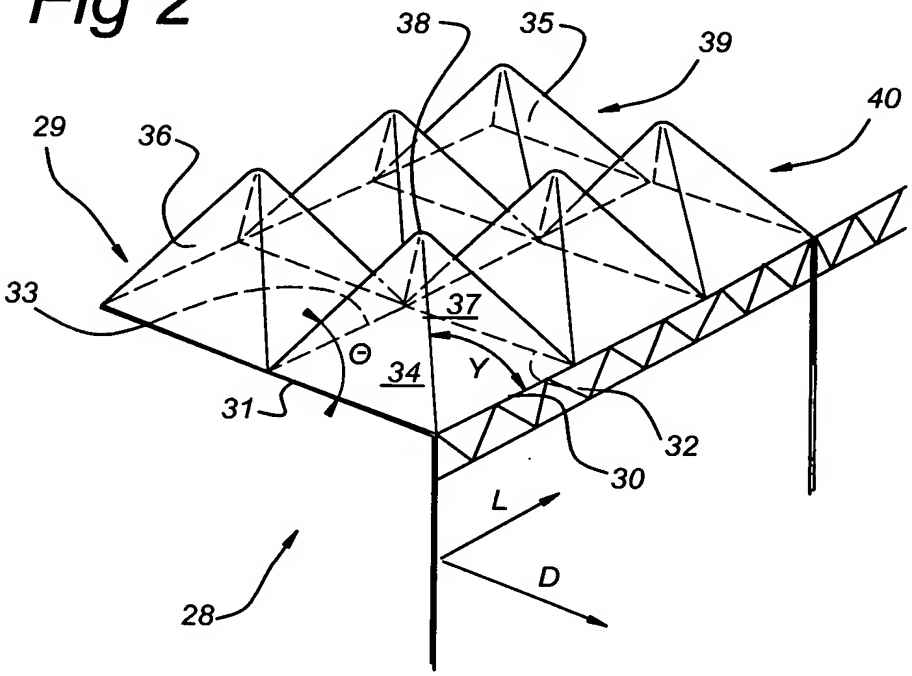
Fig 2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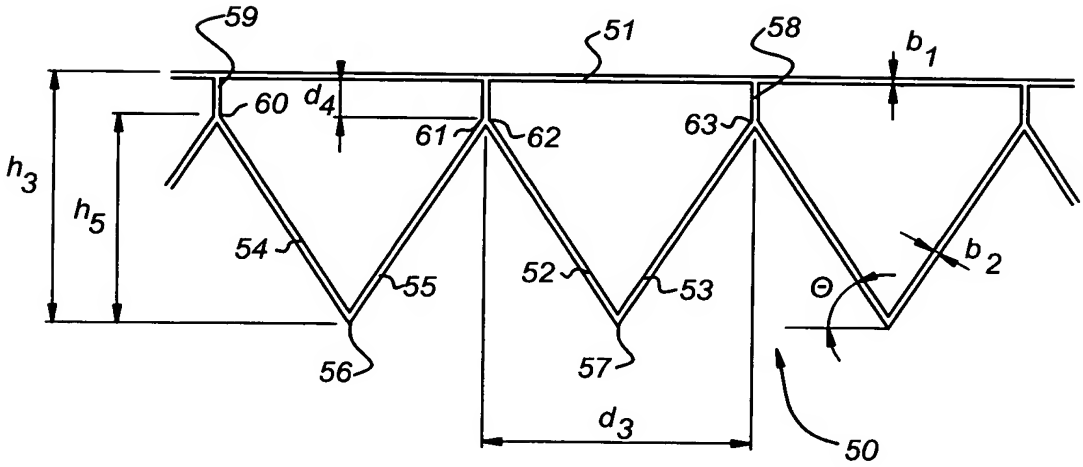
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Fig 4

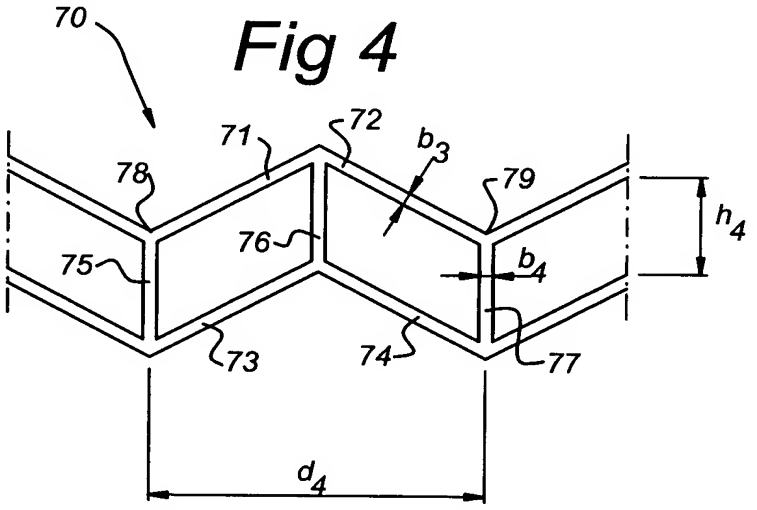
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Fig 5

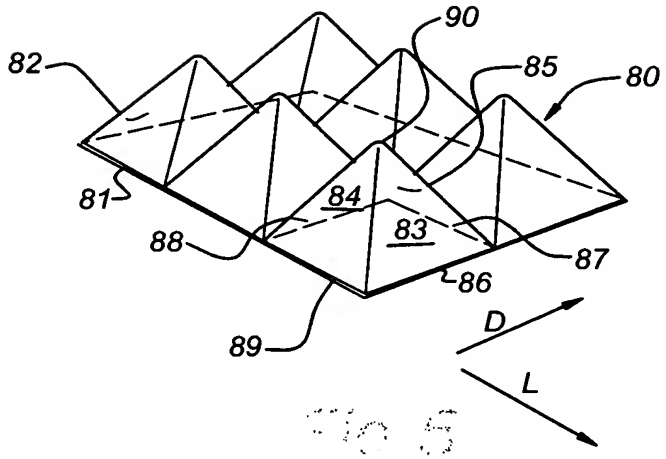

Fig 6